

The Evaluation and Closing Meeting of the National Key Project “973”

The evaluation and closing meeting of the National Key Project “973” was held at Dalian Institute of Chemical Physics (DICP) on September 29-30, 2004, attended by researchers from DICP, Xiamen University, Shanxi Coal Chemistry Institute and other research institutions. The project was about the “Catalysis Basis for the Optimal Utilization of Natural Gas and Coal-based Methane” and Prof. Xinhe Bao was the Principle Investigator. The project was divided into 7 subprojects. Among them, the 6th subproject “Direct Conversion of Methane”, was mainly undertaken by our group and we also jointly carried out the 7th subproject on “The catalysts and the relationship between the catalysts structure and performance, and the in-situ dynamic characterization”.

The evaluation committee consisting 17 experts headed by Prof. Yuan Qingtang (Academician of the Chinese Academy of Sciences), evaluated the five-year research after hearing the presentations given by the leader of the 7 subprojects and reading the written reports. The evaluation committee concluded that the project has been finished well according to the research plan; the envisioned aims have been realized; many innovative research achievements have been produced, which has a significant impact internationally. Besides, the project research has trained a group of excellent young scientists, which is also one of the important points considered during the evaluation.

Background information of the 6th subproject and the contribution of our group

The 6th subproject was initially focused on “Non-oxidative aromatization of methane” when the project was started in 1999. It was broadened to the present “Direct Conversion of Methane” in 2001 after discussion within the evaluation committee. The project was jointly carried out by Lanzhou Institute of Chemical Physics, Xiamen University, Tsinghua University, Jilin University, Dalian University of Technology, Tianjin University and Nanjing University. This subproject focused on three main topics: 1. Non-oxidative aromatization of methane for production of benzene and hydrogen; 2. New technology and new process for the oxidative coupling of methane; 3. Direct conversion of methane under low temperature and non-regular conditions. Since 1999, we have been leading the research of “non-oxidative aromatization of methane” worldwide and have gained deeper insight into the bifunctionality of Mo-based zeolite catalysts as well as the chemical nature of the carbonaceous deposits formed during the MDA reaction. Based on this knowledge, we successively improved the catalyst concerning the activity and life time. So far we have achieved a methane conversion of 13%, aromatics yield of 8.5% and life time of 28 h at 730 °C. Based on the above research we propose a theory for the methane activation and the C-C bond growth, which is expected to help further research on the non-oxidative aromatization of methane.

Besides, we also studied the activation of methane at mild conditions by applying the nanosized silver particles (4-5 nm), which were highly dispersed inside the channels of SBA-15 by in-situ reduction. The incorporated particles show higher stability due to the channels of SBA-15. These nano particles decrease the formation temperature of subsurface oxygen species and thus activate methane and form C-2 hydrocarbons at a temperature as low as 450 °C.

For more information about the evaluation, please refer to the page
<http://www.bgs.dicp.ac.cn/hwsh/2004/hwkx239.htm>